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Satoru MIYASHITA et al. | Group Art Unit: 1773

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For: METHOD OF MANUFACTURING ORGANIC EL ELEMENT, ORGANIC EL ELEMENT, AND ORGANIC EL DISPLAY DEVICE

SUBMISSION OF PRIORITY DOCUMENT WITH TRANSLATION

Director of the U.S. Patent and Trademark Office
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Sir:

Submitted herewith is a certified copy of the following prior foreign application filed in the following foreign country, along with an English-language translation thereof:

Japanese Patent Application No. 8-313828, filed November 25, 1996.

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Attachments:
Certified copy of Japanese Patent Application No. 8-313828
English-language translation of Japanese Patent Application No. 8-313828

Date: April 10, 2002

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This is to certify that the annexed is a true copy of the following application as filed with this Office

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VERIFICATION

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Kazuo Asahi

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[Name of Invention] FULL COLOR ORGANIC EL DISPLAY DEVICE AND MANUFACTURING METHOD THEREOF
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[Name of Document]	Specification and Claims	1
[Name of Document]	Drawings	1
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[NAME OF THE DOCUMENT] SPECIFICATION

[TITLE OF THE INVENTION] FULL COLOR ORGANIC EL DISPLAY DEVICE AND MANUFACTURING METHOD THEREOF

[CLAIMs]

[Claim 1] A full-color organic EL display device, CHARACTERIZED IN THAT

transparent pixel electrodes for at least red, green and blue are formed on a transparent substrate;

red and green organic luminescent layers are formed only on the transparent pixel electrodes for red and green, respectively;

a blue luminescent layer is formed over entire surfaces; and

a counter electrode is formed on them.

[Claim 2] A full-color organic EL display device, CHARACTERIZED IN THAT

transparent pixel electrodes for at least red, green and blue and thin-film transistors (hereinafter, referred to as TFT) for driving respective pixels are formed on a transparent substrate;

red and green organic luminescent layers are formed only on the transparent pixel electrodes for red and green, respectively;

a blue luminescent layer is formed over entire surfaces; and

a counter electrode is formed over an entire upper surface thereof.

[Claim 3] A full-color organic EL display device, CHARACTERIZED IN THAT

transparent pixel electrodes for at least red, green and blue are formed on a transparent substrate;

red and green organic luminescent layers are formed only on the transparent pixel electrodes for red and green, respectively;

a blue luminescent layer is formed over entire upper surfaces thereof; and

a counter electrode is formed on them.

[Claim 4] The full-color organic EL display device as claimed in Claim 3, wherein

the transparent pixel electrodes for at least red, green and blue are formed on the transparent substrate;

red and green polymeric organic luminescent layers are formed only on the transparent pixel electrodes for red and green, respectively;

a blue luminescent deposited layer is formed over entire upper surfaces thereof; and

a counter electrode is formed on them.

[Claim 5] The full-color organic EL display device as claimed in Claim 3 or 4, wherein the polymeric organic luminescent layer is hole injection type material, and the blue luminescent

deposited layer formed over the entire upper surfaces thereof is electron transfer type material.

[Claim 6] The full-color organic EL display device as claimed in any one of Claims 3 to 5, wherein

the transparent pixel electrodes for at least red, green and blue are formed on the transparent substrate;

red and green hole injection type polymeric organic luminescent layers are formed only on the transparent pixel electrodes for red and green, respectively;

a non-luminous hole injection layer is formed only on the transparent pixel electrode for blue;

an electron transfer type blue luminescent deposited layer is formed over entire upper surfaces thereof; and

a counter electrode is formed on them.

[Claim 7] The full-color organic EL display device as claimed in any one of Claims 3 to 5, wherein

the transparent pixel electrodes for at least red, green and blue are respectively formed on the transparent substrate;

hole injection type red and green polymeric organic luminescent layers are formed only on the transparent pixel electrodes for red and green, respectively;

a non-luminous hole injection layer and an electron transfer type blue luminescent deposited layer are formed over entire upper surfaces thereof; and

a counter electrode is formed on them.

[Claim 8] The full-color organic EL display device as claimed in any one of Claims 3 to 7, wherein the red and green polymeric organic luminescent layers are polyparaphenylene vinylene (hereinafter, referred to as PPV) and its derivative, or copolymer whose basic unit is made of them.

[Claim 9] A full-color organic EL display device, CHARACTERIZED IN THAT in the above EL display device, a protective film is formed on the counter electrode.

[Claim 10] A full-color organic EL display device, CHARACTERIZED IN THAT in the above EL display device; the counter electrode is sealed with a second substrate via an inert gas or an inert liquid.

[Claim 11] A method of manufacturing a full color organic EL display device, CHARACTERIZED IN THAT in the above EL display device, formation of each of the red and green organic luminescent layers is carried out by means of an ink-jet method in which a desired amount of liquid is discharged to a desired position.

[Claim 12] The method of manufacturing a full color organic EL display device as claimed in Claim 11, wherein formation of each of the red and green organic luminescent layers is carried out by:

dissolving or dispersing an organic luminescent material or its precursor in a liquid to obtain a discharge liquid;

discharging the discharge liquid by means of the ink-jet method; and then

performing a heating treatment or a light irradiation to form and fix layers.

[Claim 13] The method of manufacturing an organic EL display device as claimed in Claim 11, wherein formation of each of the red and green organic luminescent layers is carried out by:

dissolving or dispersing PPV and its derivative or copolymer, or a precursor thereof in a liquid to obtain a discharge liquid;

discharging the discharge liquid by means of the ink-jet method; and then

performing a heating treatment to form and fix layers.

[Claim 14] A method of manufacturing a full color organic EL display device, CHARACTERIZED IN THAT in the above EL display device, formation of the non-luminous hole injection layer which is carried out only on the blue transparent pixel electrode is performed by means of an ink-jet method in which a desired amount of liquid is discharged to a desired position.

[Claim 15] The method of manufacturing an organic EL display device as claimed in any one of Claims 11 to 15, wherein in the above EL display device, formation of the blue luminescent layer and the counter electrode which is the upper layer is carried out by means of a vacuum deposition method.

[Claim 16] The method of manufacturing an organic EL display device as claimed in any one of Claims 11 to 16, wherein in the above EL display device, formation of the hole injection layer

which is carried out on the entire surfaces is performed by means of a vacuum deposition method or an applying method.

[DETAILED DESCRIPTION OF THE INVENTION]

[001]

[FIELD OF THE INVENTION]

This invention relates to a full color EL display device, and relates to a method of manufacturing the EL display device using an ink-jet method.

[0002]

[DESCRIPTION OF THE PRIOR ART]

An organic EL element is an element which has a configuration in which a thin film containing a fluorescent organic compound is held between a cathode and an anode. In the organic EL element, electrons and holes are injected into the thin film to generate excitons through the recombimation of the electrons and holes. The organic EL element produces luminescence by utilizing emission of light (fluorescence or phosphorescence) at the deactivation of the excitons.

[0003]

The features of the organic EL element is that it is possible to obtain a high intensity surface luminescence on the order of 100 to 100,000 cd/m2 at a low voltage of less than 10V, and that it is possible to produce luminescence of from blue to red by the selection of the kind of fluorescent material.

[0004]

The organic EL element is drawing attraction as a device for realizing a large area full color display element at a low cost (Technical Reports of the Society of Electronic Information and Communications, Vol. 89, No. 106, 1989, p. 49). According to the report, bright luminescence of blue, green and red were obtained by forming a luminescent layer using an organic luminescent material which emits strong fluorescence. This fact is considered to mean that it is possible to realize a high brightness full color display by using an organic coloring matter which emits strong fluorescence in a thin film state and has less pin hole defects.

[0005]

In addition, in Japanese Laid-Open Publication No. Hei 5-78655, there is proposed to produce a high brightness full color element through providing a thin film layer containing an organic electron material and an organic luminescent material as components for an organic luminescent layer, and expanding the latitude in the selection of the luminescent material by preventing quenching due to higher concentration.

[0006]

Further, in Appl. Phys. Lett. Vol. 64, 1994, p. 815, it is reported that a white luminescence was obtained by using polyvinyl carbazole (PVK) luminescent layer and doping it with coloring matters corresponding to three primary colors R, G and B.

[0007]

However, in neither of the reports, the configuration or the method of manufacture of an actual full color display panel is not shown.

[0008]

On the other hand, conventionally, water-based, alcohol-based, or glycol-based ink has mainly been used in the ink-jet printing technique. This is because such ink does not invade an ink passage and an ink head material. Further, in view of the fact that an organic solvent is harmful to a human body, various types of ink-jet printers which utilize a water-base ink have been developed.

[0009]

Accordingly, in order to perform ink-jet patterning using an ink formed of an organic EL material, it is preferable that its material is soluble in water, or soluble in alcohol and glycol-based solvent. As for conventional water soluble organic EL material, a precursor of PPV can be mentioned. This precursor is transformed into salt is derived and then it dissolves in water, and it is polymerized through heating after the formation of a film, thus forming a luminescent layer. Cyanized PPV shows red luminescence. These are materials that have sufficient durability as a luminescent layer.

[0010]

In this connection, the formation of a blue luminescent

organic EL layer is usually carried out through film formation by means of a vacuum deposition method. In this case, distyl derivative has high luminous intensity and excellent durability (54th Academic Lecture Sponsored by The Japan Society of Applied Physics, Abstracts No. 3, 29p-ZC-10(1993) Page 1125).

[0011]

With regard to making ink, it is not practical to use the above-mentioned PPV-based blue luminescent material because of its poor durability and luminous intensity. Therefore, it has been said that there is a difficulty in ink-jet patterning of the blue luminescent material.

[0012]

[PROBLEM TO BE SOLVED BY THE INVENTION]

An organic thin film EL element using the organic coloring matters described above emits blue, green or red light. However, as well known, in order to realize a full color display device, it is necessary to arrange organic luminescent layers which emit any one of the three primary colors for the respective pixels. In the past, it was very difficult to carry out patterning of organic luminescent layer because of the following reasons. Namely, first, it is difficult to improve patterning precision in a deposition process, since a metal surface of a reflection electrode is unstable. Second, a polymer or precursor that forms the hole injection layer and organic luminescent layer lacks a sufficient resistance to a patterning process such as

photolithography.

[0013]

In addition, it is not possible to prepare blue luminescent material whose durability and reliability can be guaranteed, as conventional PPV-based water-soluble precursor. Therefore, it was difficult to make the blue luminescent material ink and to perform ink-jet patterning with it.

[0014]

This invention is to solve the problems described above, and it is an object to provide a full-color EL display device and a method of manufacturing the EL display device by performing patterning of red and green organic luminescent layers for the respective pixels using the ink-jet method, and forming a blue electron transfer type organic luminescent layer on a layer adjacent thereto using a vacuum deposition method.

[0015]

[MEANS FOR SOLVING THE PROBLEM]

A full-color organic EL display device according to the present invention is characterized in that

transparent pixel electrodes for at least red, green and blue are formed on a transparent substrate;

red and green organic luminescent layers are formed only on the transparent pixel electrodes for red and green, respectively;

a blue luminescent layer is formed over entire surfaces;

and

a counter electrode is formed on them.

[0016]

It is characterized in that

transparent pixel electrodes for at least red, green and blue and thin-film transistors (hereinafter, referred to as TFT) for driving respective pixels are formed on a transparent substrate;

red and green organic luminescent layers are formed only on the transparent pixel electrodes for red and green, respectively;

a blue luminescent layer is formed over entire surfaces; and

a counter electrode is formed over an entire upper surface thereof.

[0017]

It is characterized in that

transparent pixel electrodes for at least red, green and blue are formed on a transparent substrate;

red and green organic luminescent layers are formed only on the transparent pixel electrodes for red and green, respectively;

a blue luminescent layer is formed over entire upper surfaces thereof; and

a counter electrode is formed on them.

[0018]

It is characterized in that

the transparent pixel electrodes for at least red, green and blue are formed on the transparent substrate;

red and green polymeric organic luminescent layers are formed only on the transparent pixel electrodes for red and green, respectively;

a blue luminescent deposited layer is formed over entire upper surfaces thereof; and

a counter electrode is formed on them.

[0019]

It is characterized in that the polymeric organic luminescent layer is hole injection type material, and the blue luminescent deposited layer formed over the entire upper surfaces thereof is electron transfer type material.

[0020]

It is characterized in that

the transparent pixel electrodes for at least red, green and blue are formed on the transparent substrate;

red and green hole injection type polymeric organic luminescent layers are formed only on the transparent pixel electrodes for red and green, respectively;

a non-luminous hole injection layer is formed only on the transparent pixel electrode for blue;

an electron transfer type blue luminescent deposited layer

is formed over entire upper surfaces thereof; and

a counter electrode is formed on them.

[0021]

It is characterized in that

the transparent pixel electrodes for at least red, green and blue are respectively formed on the transparent substrate;

hole injection type red and green polymeric organic luminescent layers are formed only on the transparent pixel electrodes for red and green, respectively;

a non-luminous hole injection layer and an electron transfer type blue luminescent deposited layer are formed over entire upper surfaces thereof; and

a counter electrode is formed on them.

[0022]

It is characterized in that the red and green polymeric organic luminescent layers are polyparaphenylene vinylene (hereinafter, referred to as PPV) and its derivative, or copolymer whose basic unit is made of them.

[0023]

It is characterized in that in the above EL display device, a protective film is formed on the counter electrode.

[0024]

It is characterized in that in the above EL display device; the counter electrode is sealed with a second substrate via an inert gas or an inert liquid.

[0025]

It is characterized in that in the above EL display device, formation of each of the red and green organic luminescent layers is carried out by means of an ink-jet method in which a desired amount of liquid is discharged to a desired position.

[0026]

It is characterized in that formation of each of the red and green organic luminescent layers is carried out by:

dissolving or dispersing an organic luminescent material or its precursor in a liquid to obtain a discharge liquid;

discharging the discharge liquid by means of the ink-jet method; and then

performing a heating treatment or a light irradiation to form and fix layers.

[0027]

It is characterized in that formation of each of the red and green organic luminescent layers is carried out by:

dissolving or dispersing PPV and its derivative or copolymer, or a precursor thereof in a liquid to obtain a discharge liquid;

discharging the discharge liquid by means of the ink-jet method; and then

performing a heating treatment to form and fix layers.

[0028]

It is characterized in that in the above EL display device,

formation of the non-luminous hole injection layer which is carried out only on the blue transparent pixel electrode is performed by means of an ink-jet method in which a desired amount of liquid is discharged to a desired position.

[0029]

It is characterized in that in the above EL display device, formation of the blue luminescent layer and the counter electrode which is the upper layer is carried out by means of a vacuum deposition method.

[0030]

It is characterized in that in the above EL display device, formation of the hole injection layer which is carried out on the entire surfaces is performed by means of a vacuum deposition method or an applying method.

[0031]

Namely, as shown in Fig. 1, in the present invention, a transparent pixel electrode 101 for red, a transparent pixel electrode 102 for green, and a transparent pixel electrode 103 for blue are formed on a transparent substrate 104; red and green organic luminescent layers 106 and 107 are formed only on the transparent pixel electrode 101 and 102 for red and green, respectively; a blue luminescent layer 109 is formed on entire surfaces; and a counter electrode 110 is formed on them.

[0032]

In this connection, formation of the organic luminescent

layer is carried out by applying red and blue organic luminescent materials and forming a pattern using an ink-jet method. Further, formation of the blue luminescent layer is carried out using a vacuum deposition method or the like. In this way, a full-color display is realized.

[EMBODIMENTS OF THE INVENTION]

[0033]

Hereinafter, preferred embodiments of the present invention will be described with reference to the drawings.

[0034]

(Example 1)

As shown in Fig. 1, on a glass substrate 104, ITO transparent pixel electrodes 101, 102 and 103 are formed by means of photolithography so as to form a pattern having a pitch of 100μm and a thickness of 0.1μm. Then, resin black resists are buried in the spaces between the ITO patterns, and then structures 105 which act not only as a light cut-off layer but also an ink drop preventing wall are formed by the photolithography. Each of the black resists has a width of 20μm and a thickness of 1.0μm.

[0035]

Then, coating and pattern formation of red and green luminescent materials are carried out using an ink-jet printing device 108 to form luminescent layers 106 and 107 having a thickness of 0.05μm. A precursor of cyanopolyphenylene vinylene is used for the red luminescent material, and a precursor

of polyphenylene vinylene is used for the green luminescent material. These organic EL materials are produced by Cambridge Display Technology Ltd., and they are obtainable in the form of liquid. After discharging in an ink-jet manner, the precursor of polymer is subjected to heat treatment to polymerize it, thereby forming luminescent layers 106 and 107.

[0036]

Next, the vacuum deposition is carried with aluminum quinolinol complex to form an electron transfer type blue luminescent layer 109 having a thickness of 0.1μm.

[0037]

Finally, an MgAg reflection electrode 110 having a thickness of 0.1 to 0.2μm is formed using a deposition method.

[0038]

In this way, a direct-view type full-color organic EL display device is manufactured.

[0039]

(Example 2)

As shown in Fig. 2, on the glass substrate 204, ITO transparent pixel electrodes 201, 202 and 203 are formed by means of the photolithography so as to form a pattern having a pitch of 80μm and a thickness of 0.1μm. Then, resin black resists are buried in the spaces between the ITO patterns, and then structures 205 which act not only as a light cut-off layer but also an ink drop preventing wall are formed by the

photolithography. Each of the black resists has a width of 10μm and a thickness of 1μm.

[0040]

Then, coating and pattern formation of red and green luminescent materials are carried out using an ink-jet printing device 209 to form luminescent layers 206 and 207. A precursor of cyanopolyphenylene vinylene is used for the red luminescent material, and a precursor of polyphenylene vinylene is used for the green luminescent material. These organic EL materials are produced by Cambridge Display Technology Ltd., and they are obtainable in the form of liquid. After discharging in an ink-jet manner, the precursor of polymer is subjected to heat treatment to polymerize it, thereby forming luminescent layers 206 and 207.

[0041]

Further, polyvinyl carbazole (PVK) is discharged as a hole injection layer onto the transparent electrode 203 using the ink-jet printing device to form a layer 208.

[0042]

Then, pyrazoline dimer is applied using a coating method to form a blue luminescent layer 210 over the entire surface of a substrate.

[0043]

Finally, an AlLi reflection pixel electrode 211 is formed.

[0044]

In this way, a full-color organic EL display device is manufactured.

[0045]

(Example 3)

As for organic luminescent material for an organic luminescent layer, 2,3,6,7-tetrahydro-11-oxo-1H,5H,11H-(1)benzopyrano[6,7,8-ij]-quinolizine-10-carboxylic acid is used, and as for hole injection layer material, 1,1-bis-(4-N,N-ditrile aminophenyl)cyclohexane is used. A green luminescent material is prepared by mixing these materials.

[0046]

Similarly, as for red organic luminescent material, 2-13',4'-dihydroxyphenyl)-3,5,7-trihydroxy-1-benzopyrylium perchlorate is used, which is mixed with the hole injection layer material.

[0047]

In addition, as for organic hole injection material for a blue luminescent layer, tris(8-hydroxyquinolinol)aluminium is used, and as for organic luminescent material, 2,3,6,7-tetrahydro-9-methyl-11-oxo-1H,5H,11H-(1)benzopyrano[6,7,8-ij]-quinolizine is used. A luminescent material is prepared by mixing these materials.

[0048]

In the same processes as in Example 1 or 2, local patterning

of each luminescent layer is performed using an ink-jet printing device to manufacture an organic EL display device.

[0049]

(Example 4)

As shown in Fig. 3, on the glass substrate, ITO transparent pixel electrodes 301, 302 and 303 are formed by means of photolithography so as to form a pattern having a pitch of 80μm and a thickness of 0.1μm. Then, resin black resists are buried in the spaces between the ITO patterns, and then structures 304 which act not only as a light cut-off layer but also an ink drop preventing wall are formed by photolithography. Each of the black resists has a width of 10μm and a thickness of 1μm.

[0050]

Then, coating and pattern formation of red and green luminescent materials are carried out using an ink-jet printing device 307 to form luminescent layers 305 and 306. A precursor of cyanopolyphenylene vinylene is used for the red luminescent material, and a precursor of polyphenylene vinylene is used for the green luminescent material. These organic EL materials are produced by Cambridge Display Technology Ltd., and they are obtainable in the form of liquid. After discharging in an ink-jet manner, the precursor of polymer is subjected to heat treatment to polymerize it, thereby forming luminescent layers 305 and 306.

[0051]

Then, vacuum deposition is carried out with polyvinyl carbazole (PVK) to form hole injection layers 308 on an entire surface of a substrate.

[0052]

Then, distyl derivative (produced by Idemitsu Kosan Co. Ltd.) is applied onto the entire surface of a substrate to form a blue luminescent layer 309.

[0053]

Finally, an AlLi reflection pixel electrode 310 is formed.

[0054]

In this way, a full-color organic EL display device is manufactured.

[0055]

(Example 5)

As shown in Fig. 4, an organic protective film 407 is formed on the organic EL display device manufactured in Example 1 using a spin coating method by JSS (Japan Synthetic Rubber Co., Ltd.).

[0056]

(Example 6)

Thin-film transistors are formed on a glass substrate, and then ITO transparent pixel electrodes are formed. Then, the same processes as in Example 1 are carried out. Next, as shown in Fig. 5, the organic EL display device is kept under argon atmosphere 506 using a peripheral seal 509 and a sealing member 508. In this way, a life span of a full-color organic

EL display device is extremely prolonged.

[0057]

(Example 7)

As shown in Fig. 6, thin-film transistors 604 are formed on a glass substrate, and then ITO transparent pixel electrodes 603 are formed.

[0058]

Then, coating and pattern formation of red and green luminescent materials are carried out using an ink-jet printing device to form luminescent layers 605 and 606 having a thickness of 0.05μm. A precursor of cyanopolyphenylene vinylene is used for the red luminescent material, and a precursor of polyphenylene vinylene is used for the green luminescent material. These organic EL materials are produced by Cambridge Display Technology Ltd., and they are obtainable in the form of liquid.

[0059]

Next, the same processes as in Example 1 are carried out to manufacture an active matrix type full-color organic EL display device.

[0060]

In addition to the organic EL materials used in the above-mentioned Examples, aromatic diamine derivative (TPD), oxydiazole derivative (PBD), oxydiazole dimer (OXD-8), distylarylene derivative (DSA), beryllium-benzoquinolinol complex (Bebq), triphenylamine derivative (MTDATA), rubrene,

quinacridone, triazole derivative, polyphenylene, polyalkylfluorene, polyalkylthiophene, azomethine zinc complex, polyphyrin zinc complex, benzo oxazole zinc complex, phenanthroline europium complex may also be used, but materials used in this invention is not limited to these materials.

[0061]

Specifically, known materials such as materials disclosed in Japanese laid-open publication Nos. Show63-70257, Show63-175860, Hei02-135361, Hei02-135359, and Hei03-152184 may be used. These compounds may be used alone or in combination of two or more.

[0062]

When a layer made of 1,2,4-triazole derivative (TAZ) is provided as a buffer layer between the respective layers, the luminance and luminescence life are improved.

[0063]

When a hole transfer type EL material is provided by doping the fluorescent dye to PVK, such as 1,1,4,4-triphenyl-1,3-butadiene (blue), quartamin 6 (green) and DCM1 (red), the luminance and luminescence life are improved.

[0064]

As for an applying method for forming an organic layer, it is effective to use a spin coating method, a casting method, a dipping method, a bar coating method, a roll coating method, or the like.

[0065]

[EFFECTS OF INVENTION]

By carrying out the formation and arrangement of an organic EL material using the ink-jet method, it becomes possible to achieve patterning of an organic EL material which has been said to be impossible to achieve before. As a result, it becomes possible to realize full-color displaying organic EL display device. This makes it possible to manufacture full-color display devices having large screen size at a low cost, which will have excellent results.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[Figure 1]

Fig. 1 is a drawing which shows processes of manufacturing a first embodiment of an organic EL display device according to the present invention.

[Figure 2]

Fig. 2 is a drawing which shows processes of manufacturing a second embodiment of the organic EL display device according to the present invention.

[Figure 3]

Fig. 3 is a drawing which shows processes of manufacturing a fourth embodiment of the organic EL display device according to the present invention.

[Figure 4]

Fig. 4 is a sectional view which shows the structure of

a fifth embodiment of the organic EL display device according to the present invention.

[Figure 5]

Fig. 5 is a sectional view which shows the structure of a sixth embodiment of the active matrix type organic EL display device according to the present invention.

[Figure 6]

Fig. 6 is a top view which shows the structure of a seventh embodiment of the active matrix type organic EL display device according to the present invention.

[DESCRIPTION OF THE REFERENCE MARKS]

101 Transparent Pixel Electrode (Red)

102 Transparent Pixel Electrode (Green)

103 Transparent Pixel Electrode (Blue)

104 Glass Substrate

105 Resin Black Resist

106 Organic Luminescent Layer (Red)

107 Organic Luminescent Layer (Green)

108 Ink-Jet Printer Head

109 Organic Luminescent Layer (Blue)

110 Counter Electrode

201 Transparent Pixel Electrode (Red)

202 Transparent Pixel Electrode (Green)

203 Transparent Pixel Electrode (Blue)

204 Glass Substrate

205	Resin Black Resist
206	Organic Luminescent Layer (Red)
207	Organic Luminescent Layer (Green)
208	Hole Transfer Layer
209	Ink-Jet Printer Head
210	Organic Luminescent Layer (Blue)
211	Counter Electrode
301	Transparent Pixel Electrode (Red)
302	Transparent Pixel Electrode (Green)
303	Transparent Pixel Electrode (Blue)
304	Resin Black Resist
305	Organic Luminescent Layer (Red)
306	Organic Luminescent Layer (Green)
307	Ink-Jet Printer Head
308	Hole Transfer Layer
309	Organic Luminescent Layer (Blue)
310	Counter Electrode
401	Glass Substrate
402	Organic Luminescent Layer (Red)
403	Organic Luminescent Layer (Green)
404	Transparent Pixel Electrode (Blue)
405	Organic Luminescent Layer (Blue)
406	Counter Electrode
407	Protective Film
501	Glass Substrate

502	Organic Luminescent Layer (Red)
503	Organic Luminescent Layer (Green)
504	Transparent Pixel Electrode (Blue)
505	Organic Luminescent Layer (Blue)
506	Counter Electrode
507	Protective Substrate
508	Sealing Member
509	Peripheral Seal
510	Silver Paste
511	Bus Line
512	Argon Gas
601	Signal Line
602	Gate Line
603	Pixel Electrode
604	Thin-Film Transistor
605	Organic Luminescent Layer (Red)
606	Organic Luminescent Layer (Green)

[TITLE OF THE DOCUMENT] ABSTRACT

[ABSTRACT]

[MEANS FOR SOLVING PROBLEMS] By carrying out the formation and arrangement of an organic EL material, which has been said to be impossible to achieve patterning before, using the ink-jet method, it becomes possible to achieve desirable patterning of organic EL materials each of which can emit red, green or blue light for respective pixels. As a result, it becomes possible to realize full-color displaying organic EL display device.

[EFFECTS] This makes it possible to manufacture full-color display devices having large screen size at a low cost, which will have excellent results.

[DESIGNATED DRAWING] Fig. 1

Fig. 1

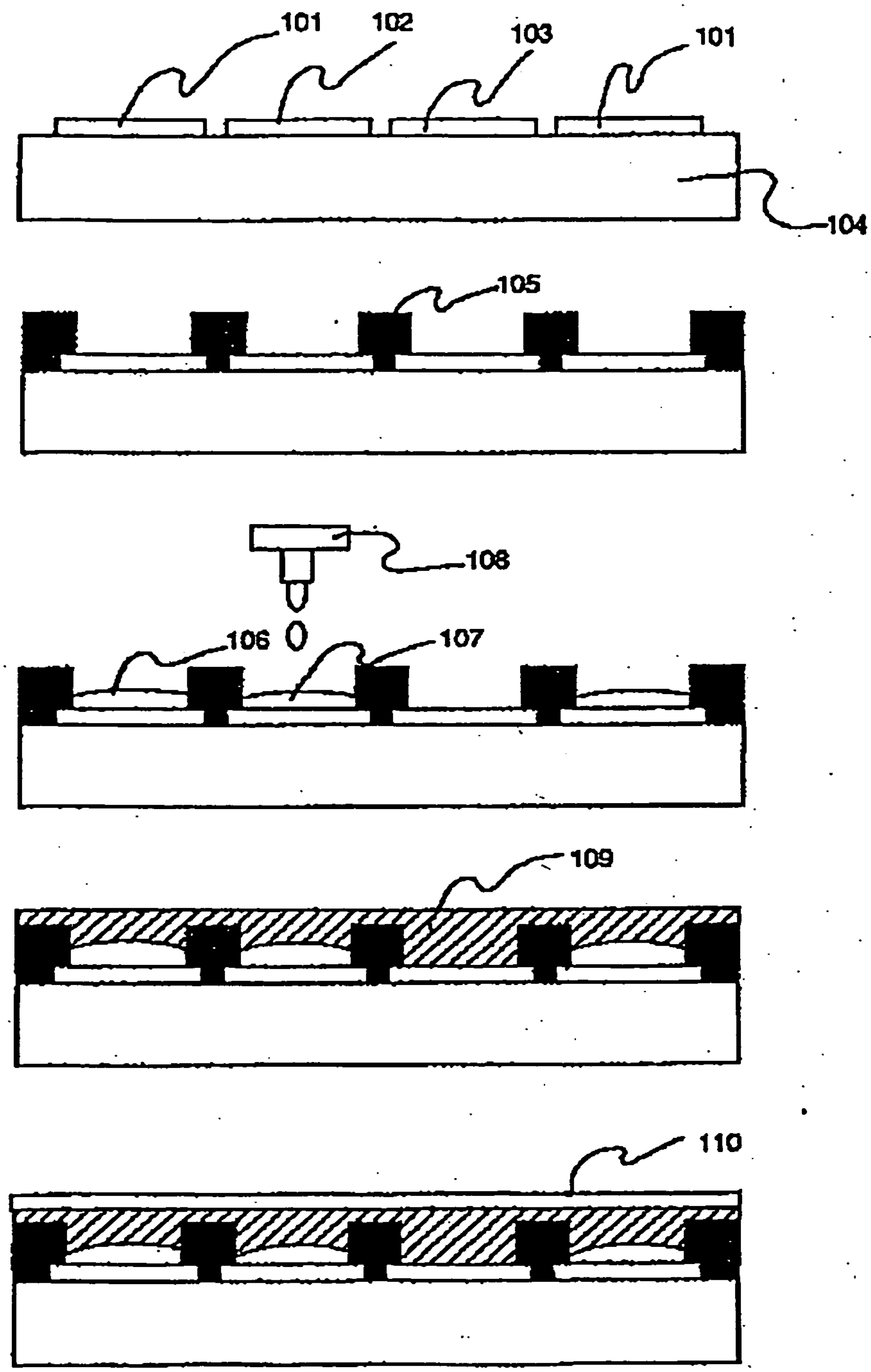


Fig. 2

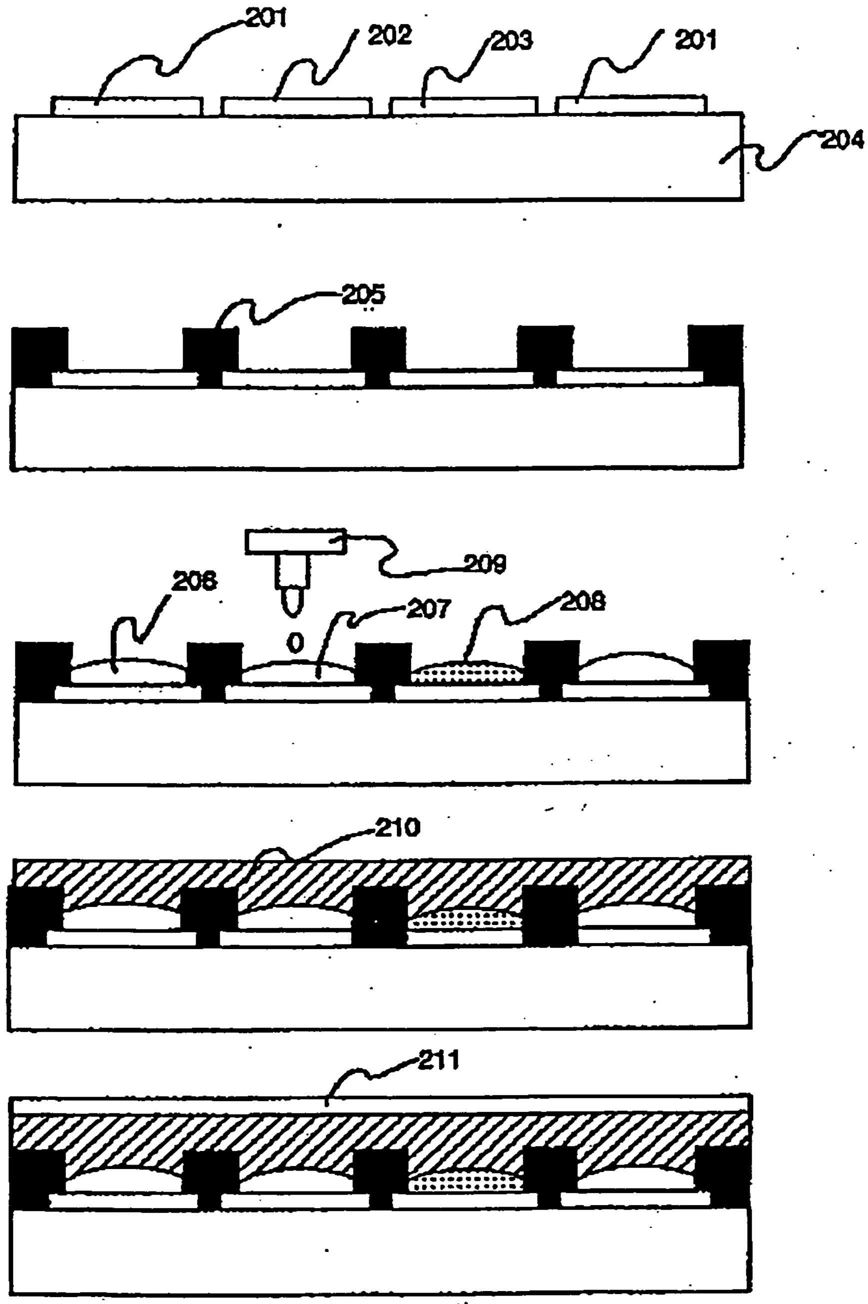


Fig. 3

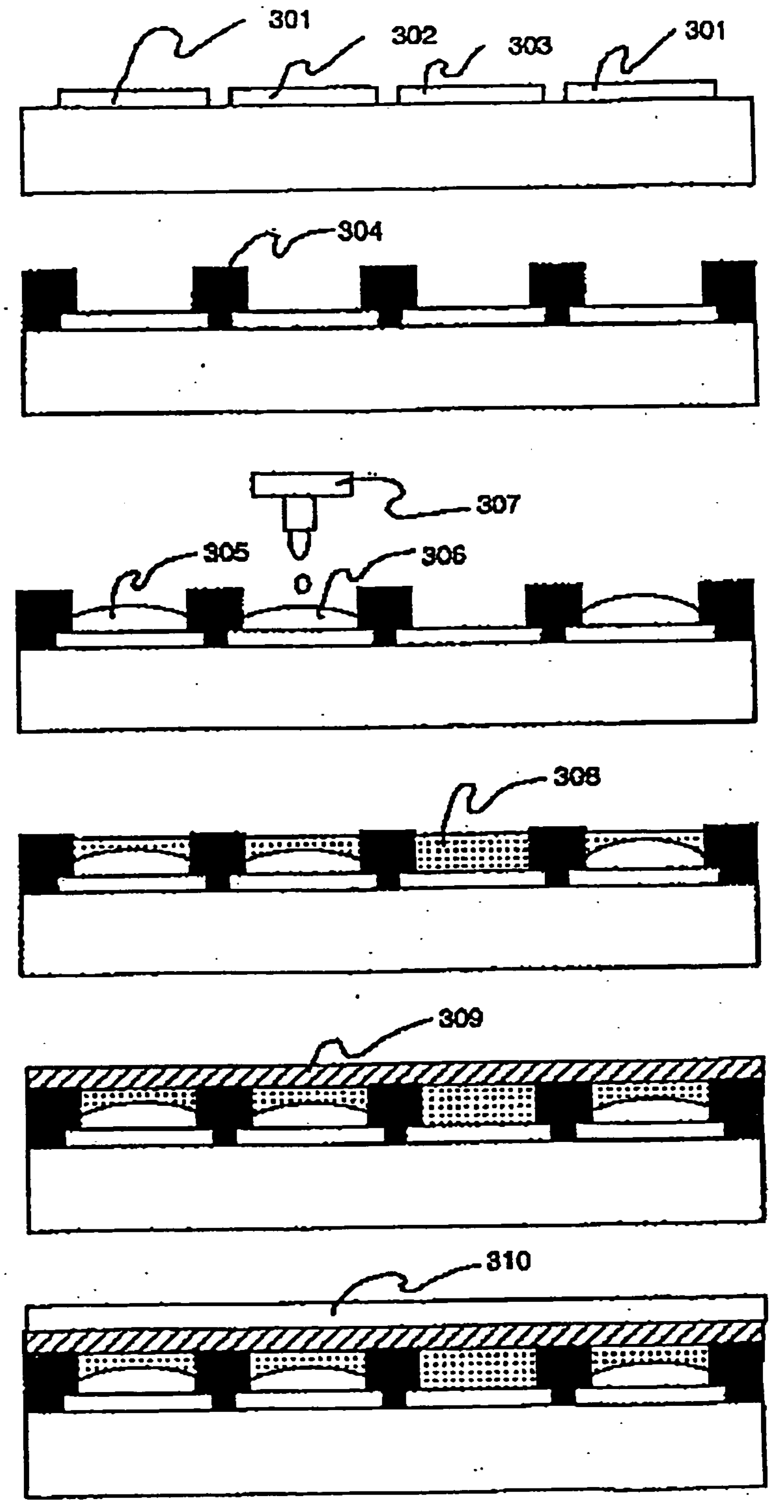
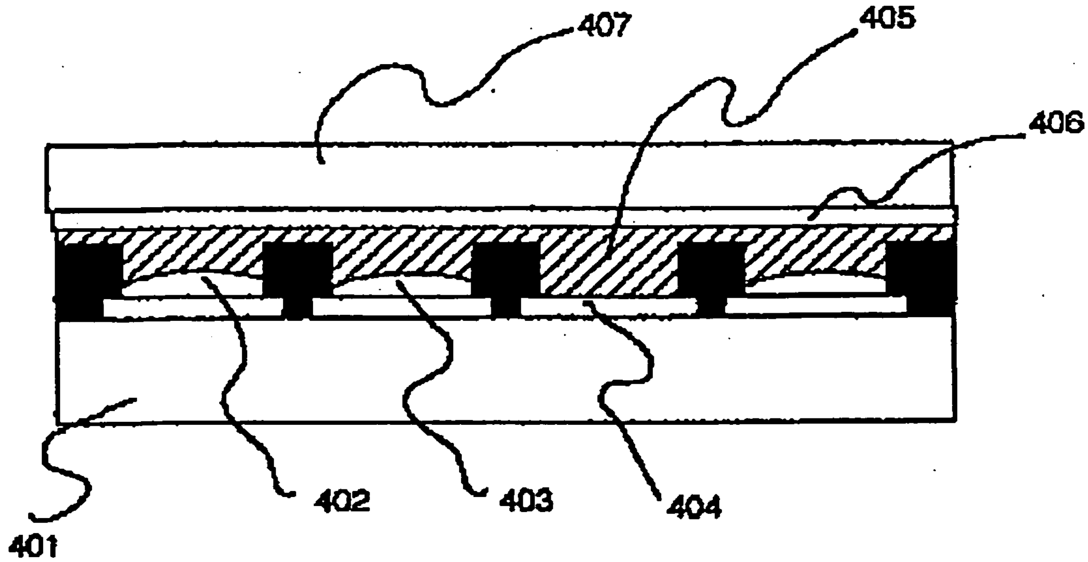


Fig. 4



F i g. 5

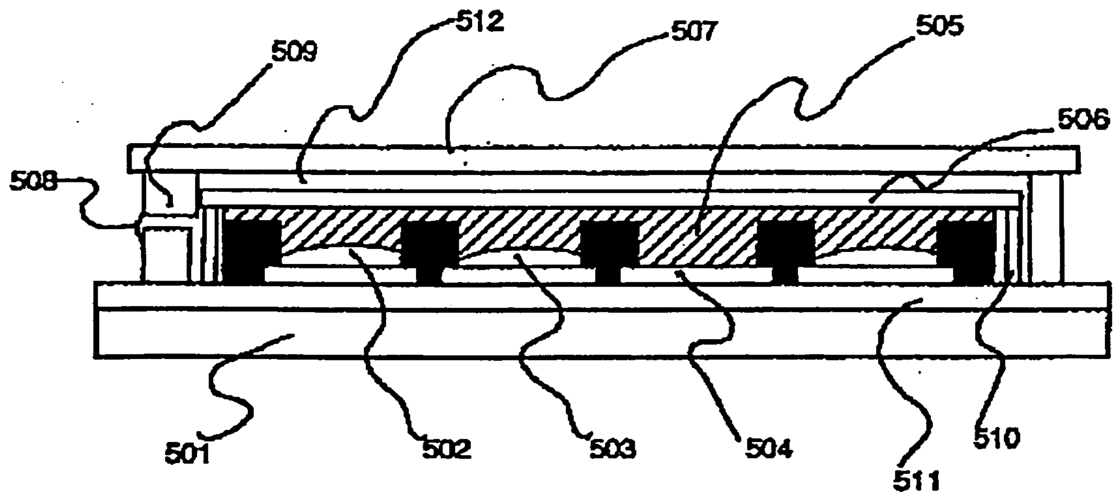


Fig. 6